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THE ALASKA FOREST RESEARCH CENTER

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CONTENTS

Page

INTRODUCTION

The Alaska Forest Research Center, established July 1, 1948, has made significant gains during its short existence. The year 1954 was especially significant in that two new and much needed lines of work were added; the Forest Survey, and Forest Insect Surveys. Since the first analysis of the problems of Southeast Alaska was made it was evident that the nationwide inventory of forest resources should be extended to Alaska, especially Southeast Alaska where the first of several expected pulp mills was being established. The inventory of Southeast Alaska's forests, consisting primarily of the Tongass National Forest, will supply detailed data to replace old extensive cruises that in their day were satisfactory, but now are inadequate for the development of industry on a large scale.

The insect survey program during 1952 and 1953 had been carried on first by the Forest Insect Laboratory of the Bureau of Entomology in Portland, then by the Division of Forest Entomology of the Pacific Northwest Forest and Range Experiment Station. On July 1, 1954 the program for Alaska was transferred to the Alaska Forest Research Center at Juneau. The survey of insect conditions covers all of Alaska's forest land, but during the past two years a large part of the time has been necessarily spent on following the progress of the black-headed budworm epidemic centered largely in Southeast Alaska.

Forest management research was given added impetus by the beginning of large-scale logging at Hollis for the new pulp mill at Ketchikan. For 5 years much of the management research has been centered around Hollis on Prince of Wales Island in the expectation that first pulp mill cuttings would be made there.

As this is the first of our annual reports to be issued for general distribution, it includes brief explanations of past work to bring the reader up to date.

THE FOREST SURVEY

The forest survey now underway in Southeast Alaska is part of the nationwide inventory of our national forest resources. Its purpose is to find out how much timber there is, where it is, what condition the forests are in, and to keep this information current by periodic resurveys.

This national survey of our forests is the only comprehensive source of facts on the condition and use of United States timber resources - one of the nation's basic natural resources. Congress authorized the task of conducting a national survey of our forests in 1928. With only one interruption - World War II - the survey has been going on ever since. At present over 70 percent of the initial job in the continental United States has been completed. The 83rd Congress amended the Act of 1928 to extend the Forest Survey to the Territories and Possessions of the United States. On July 1, 1954 the survey was initiated in Southeast Alaska. It is expected that with the funds presently available it will take four years to survey the timber stands from Dixon Entrance to Yakutat Bay - a gross land area of over 21 million acres. Later, as additional funds become available it is expected that the survey will cover the Interior and remainder of Coastal Alaska.

The need for a forest survey

The tremendous drain on our forest resources during World War II, our vast post-war building program, our expanding economy and increasing population, the current world shortage of timber products, and potential military requirements are reasons enough that we must have accurate, up-to-date knowledge of how much timber is available, how the supply is changing, and probable trends in future demands on the forest resource. Forest products are vital to the economic welfare and security of the United States. But what of Southeast Alaska?

Only a very small fraction of the allowable timber cut is harvested annually. Consumption of Alaskan timber products by Alaskans will probably never equal the forest growth. But the timber economy of the future is bright and promising. The key to our timber economy is export. And the most important product will be woodpulp for which our timber of Southeast Alaska is most admirably suited.

In the United States woodpulp production is twice what it was just before World War II; nearly five times what it was in 1919; and 700 times more than 75 years ago. Every day's edition of the newspapers of the United States requires 15,000 tons of newsprint - about 80 percent of which must be imported from Canada. The demand for woodpulp for paper, rayon, cellophane, plastics, acetate, etc. in the U.S.A. has increased over 60 percent in just the past six years while population has increased only 10 percent. Population growth experts predict a population in the U.S.A. of 193 millions by 1975. What 40 million more people in this country in just 21 years will require is not too difficult to visualize. Not to be ignored, too, is the increasing demand for woodpulp and paper from foreign countries.

These facts, of course, prove without question that we have good reason to be concerned about our forest resource and its effect on Alaskan prosperity through a steady, year-round payroll and stable communities. Timber is a renewable resource, but it is not one that can be grown in a few years.

Responsibility for the conduct of the survey

The McSweeney-McNary Act of 1928 authorized the Secretary of Agriculture to undertake a nationwide "Forest Survey". The responsibility for the conduct of the survey was then delegated to the U. S. Forest Service which in turn authorized its various research stations throughout the country to obtain the necessary facts. Here in Alaska the job is under the general supervision of the Alaska Forest Research Center.

Originally the survey was designed to be broad in scope - on a national or regional level. The construction of Alaska's first pulp mill at Ketchikan and the increasing interests of other pulp firms in the timber resource of Southeast Alaska has made it imperative that the administrators of the Tongass National Forest obtain useful facts at a local level- areas suitable to support additional pulp mills and other wood-using industries. With this in mind the survey has become a cooperative venture between the two Forest Service organizations in Alaska; Region 10 which administers the national forests, and the Alaska Forest Research Center.

Kinds of facts obtained and methods used

The forest survey obtains useful data on: (1) the extent and condition of forest land; (2) the volume, species, quality, and location of standing timber; (3) ownership of forest land; (4) rates of timber growth and mortality; (5) timber cut for lumber, pulp, and other forest products; and (6) present consumption and prospective requirements for various timber products.

In addition to obtaining basic statistics on forest resources the survey also provides maps of forest types and condition classes, as well as an analysis of forest resource information on both a local and national basis.

The system of obtaining the essential facts about the forest resource is mathematically designed to obtain the greatest accuracy possible for the amount of money available.

The most important working tool is aerial photography. Photo prints are selected for a specific area from photo index sheets. Then a number of point locations - called photo plots - are placed on each photo. These plots, in effect, are a systematic sample of the area. The total number of plots required for examination is calculated according to a statistical formula to obtain a certain desired accuracy of the area of forest land.

These plots are then examined under a stereoscope by trained photo-interpreters. The first step is to classify each plot as forest or non-forest. If a plot is nonforest it is further classified as: barren, muskeg, brush, marsh, grass, water, settlements, etc. If a plot is forest, it is studied more carefully under the stereoscope and further classified according to the size of the timber on it, its location, and the stocking or density of the stand.

Thus the forest area is stratified. This provides the basis for the field sampling to follow. It also reduces the sampling errors so that for the same number of field plots a greater accuracy of the volume of timber can be obtained.

A sample of the photo plots is randomly selected for on-the-ground examination. This step serves as a check on the accuracy of photo-interpretation and obtains certain information not identifiable on photos - growth, defect, tree diameter, quality, etc.

Field crews, usually consisting of two men, visit each selected plot. Transportation to field plot locations is by boat or plane and thence by foot.

Reports

The first product that will come out is a set of statistics on forest acreage and timber volume for each timber management unit of the Tongass National Forest. These releases are followed by a statistical report for the Tongass as a whole plus statistics of other forest land ownerships in Southeast Alaska.

The final step in the Forest Survey is the publication of a printed report containing not only basic statistics but also a description of the forest industries, their role in the economic life of Alaska, and a general analysis of the forest situation.

Uses of survey data

Originally the survey was designed to provide national and regional information on timber resources. Local needs, however, have become of paramount importance. The U. S. Forest Service, forest industries, transportation groups, chambers of commerce, and many others interested in use and development of our forest resources have urgent need for this inventory data. The future development of the pulp industry of Southeast Alaska is dependent upon an accurate inventory of our standing timber. Since most of Southeast Alaska's timber is in the Tongass National Forest the U. S. Forest Service is vitally concerned with the results of this survey. How many tons of pulp - in addition to other forest products - can be produced from the Tongass in perpetuity? How many pulp mills can profitably operate in this region? Where, how much, and what kind of timber is there in relation to prospective pulp plant locations? These and many other questions will be answered by the survey. And it is only

with reliable data and accurate forest-cover maps that the Forest Service can formulate sound timber management plans - as much as 50 years in advance - for developing this vast resource.

Progress of forest survey - 1954

1. Re-inventory of the Ketchikan Pulp Company timber sale area. Region 10 of the U. S. Forest Service and the Ketchikan Pulp Company undertook a re-inventory of the K.P.C. sale area to obtain more intensive resource data for the sustained yield management of the stands involved. The survey was brought into the picture since it is interested in obtaining resource information for the region as a whole. Much of the data collected on the K.P.C. survey can and will be incorporated into the survey of Southeast Alaska. The forest survey cooperated by supplying a proportion of the funds and manpower. The survey participated in the examination of 85 ground plots and preparation of a type map involving over 700,000 acres of land.

2. Prepared a plan and manual for the forest survey of Southeast Alaska.

3. The interpretation and classification of over 13,000 photo plots involving an area of about 9,622,000 acres of land, was completed. This area is the Juneau Unit, one of four units of Southeast Alaska.

Accomplishments of the forest survey of Southeast Alaska in 1954

Percent of forest land inventoried	- 6.3
Percent of total area photo-classified	- 45.6
Percent of total forest area photo-classified	- 32.1
Percent of total job completed	- 8.0

Plans for 1955

1. Using aerial photos, prepare a type map, at 2 inches to the mile, for the first 10-year operating area of the Sitka pulp allotment unit, a gross land area of about 375,000 acres.

2. Complete the survey of all ground plots in the Juneau unit.

3. Commence compilation of data obtained from ground plots in the Juneau unit.

4. Commence type-mapping of the Juneau unit.

5. Prepare a Drain working plan for Southeast Alaska. This involves not only the annual forest drain but also utilization and waste studies.

6. Conduct a sample of going logging operations in the Juneau unit to obtain utilization and waste factors. These factors will be combined with future samples from other operations in Southeast Alaska to obtain average factors which will be applied to the drain of the entire region.

Small scale preliminary research between 1924 and 1934 carried on by the Tongass National Forest staff showed:

1. That clearcutting of sawtimber areas up to 300 acres in area restocked naturally within a few years to species of commercial value. Ten years after cutting the area was satisfactorily stocked.

2. Second-growth following the removal or destruction of old-growth by windstorm, old Indian cuttings or slides produces, on the average, twice as much volume of wood per acre in 100 years as the average old-growth climax forest maintains. At the time this work was done there were no large logged areas old enough for study of second-growth stands.

Harvesting Methods

Southeast Alaska's forests are 95 percent old-growth climax which has a low volume per acre and is in an unhealthy condition due to overmaturity of most of the trees. No form of partial cutting can be considered as a silvicultural system. Reserved trees would not grow and would in many cases windfall. Reproduction would be largely sparsely stocked, slow growing hemlock. Any partial cutting system would be uneconomical as loggers could not afford to cut but a third of the 20 to 30 thousand board feet per acre that is normal for the climax. Cutting more than one-third would result in heavy windfall. The problem is to convert these old stands into fast growing, healthy, young forests by clearcutting.

This general problem can be broken down into several parts:

a. <u>How large an area can be clearcut with assurance of natural regeneration</u>?

   Logging prior to 1954 did not clear large areas and dealt largely with pockets of the best sawtimber. To determine whether areas large enough to prevent natural seeding would be cut in pulptimber logging, surveys were made of some typically good and typically poor tracts of timber.

   Results indicated that very few large clearcuttings would be made. Stringers and small islands of unmerchantable timber would have to be left which would insure not too great distances for natural seeding. The question of quality of seed from live culls on the cutting and from semi-scrub stands bordering it will require long-time study. It is not necessarily true that scrub stands on poor sites are genetically poor quality trees and undesirable as a source of seed.

   Carrying on these surveys resulted in the development of a method for using low oblique aerial photographs. A handbook was prepared for use by administration and the forest survey in Alaska.

The old-growth, all-aged climax forest holds its own by replacing falling veterans with slow growing hemlock reproduction.

The surveys indicated that there was reasonable doubt that early extensive pulptimber cruises were accurate enough as to types and volumes shown for development of adequate management plans. This led to the extension of the forest survey to Alaska.

Pulptimber cutting in Alaska began in 1953. The largest clear-cutting which is on the Maybeso watershed has been set up for research to test the effectiveness of seeding at distances up to 40 chains from the nearest seed source. Seed traps and transects are being established as cutting proceeds. This cutting was made intentionally large for the purpose of determining whether seed tree blocks would be necessary.

b. <u>If some clearcut areas are too large to seed naturally, should seed be provided by seed trees left in groups or singly, or will some form of artificial seeding or planting be necessary</u>?

Whether seed tree blocks, staggered settings, or individual seed trees are needed depends upon whether they are left for seed alone, or also for barriers to the spread of fire. The case of fire is covered in a later section; it is not considered much of a problem in Southeast Alaska where the heavy rainfall is distributed throughout the year. In addition to investigating the fall of seed at greatest probable distances, and the resultant stocking and survival, studies of the live culls which were left singly and in groups on cutover areas are being made. There are questions as to how long they

live, how long they remain standing, and whether their exposure through cutting increases cone production.

On a sample area of 46 acres yarded for pulp by high-lead in 1954, there were 5 or 6 live trees per acre left standing after yarding, 3 of which were 10 inches in diameter or larger. About 80 percent of these were hemlock. High-lead hauling had already knocked down a great many unmerchantable trees. A much greater number of such trees are left where tractor yarding is used; sometimes there are as many as 30 per acre and often patches of hemlock poles averaging 8 inches in diameter remain.

c. How should the area be cut, or treated after logging, to insure a good seed bed?

Past studies of cutover areas have shown that tearing up the forest floor in logging, which results in mixing the acid humus and litter with the mineral soil creates the best seedbed and results in the best survival and early growth of seedlings. This is particularly necessary in Southeast Alaska where the cool, humid climate and virgin forest conditions have built up a deep, acid humus layer.

Optimum seedbed conditions occurred where the unincorporated organic layer was mixed, through logging disturbance, with the underlying mineral soil resulting in a heterogeneous mixture of the two. In actuality all phases of disturbance of the forest floor occurred from simply removing the surface moss layer, to complete scalping of the organic layer.

Exposed mineral soil, whether incorporated with organic matter or not, was considered a suitable seedbed. Where heavy unscattered slash occurred, seedbed conditions were considered undesirable regardless of the nature of the underlying ground surface. Where moderate or light slash accumulations existed, the nature of the ground surface governed the classification. Conditions were considered unsuitable where the organic layer was essentially undisturbed and mixing of the organic and mineral fractions did not occur.

For the visual estimates 3 categories of classification were used in mapping the 10-acre units: (1) more than 60 percent suitable seedbed, representing good conditions; (2) 30-60 percent suitable seedbed, representing moderately good conditions; and (3) less than 30 percent suitable seedbed, representing poor conditions. A total of 139 acres of yarded area were mapped in this manner. The following breakdown by type of yarding existed:

Table 1. Visual estimate of quality of seedbed by type of yarding.

Seedbed condition	Type of Yarding: High-lead Area, acres	High-lead % of total	Cat Area, acres	Cat % of total	All Area, acres	All % of total
Good	24	22	—	—	24	18
Moderate	65	59	15	53	80	58
Poor	21	19	13	47	34	24
Total	110	100	28	100	138	100

During the latter part of the season a different sampling technique, using a line transect concept, was devised to permit a more accurate estimation and allow the consideration of various types of seedbeds. These were tallied by links along the chain when running control lines between and within 10-acre units of the cutover area. The type of conditions recognized were:

1. Suitable seedbed. Exposed mineral soil.

2. Undisturbed A_0. Very light or no disturbance at all. Surface moss layer still intact.

3. Disturbed A_0. Enough disturbance of the organic layer to incorporate or remove the surface moss but very little or no incorporation with underlying mineral soil.

4. Heavy slash. Heavy, dense slash accummulations which would seriously inhibit the penetration of sunlight.

5. Road and right-of-way. Mainline and spur roads, including right-of-way.

In addition to a more accurate estimate several other advantages exist when using this technique. Hemlock seedlings, established prior to felling, are usually abundant where undisturbed organic layers predominate. These seedlings may survive under the present conditions and comprise part of the future stand. The condition described as "disturbed A_0" may be quite suitable for germination and survival, possibly more so for hemlock than spruce. The removal of the moss eliminates the serious physical barrier. A total of 35 acres were mapped in this manner. The following table presents the area breakdown by seedbed conditions and type of yarding:

Table 2. Proportion of area by various seedbed conditions. Line plot mapping.

Seedbed condition	High-lead Area, acres	High-lead % of total	Cat Area, acres	Cat % of total	All Area, acres	All % of total
Suitable seedbed	4.7	31.1	6.7	34.0	11.4	32.8
Disturbed A_o	3.8	25.2	0.6	3.0	4.4	12.6
Undisturbed A_o	2.1	13.9	4.7	23.9	6.8	19.5
Heavy slash	4.5	29.8	6.7	34.0	11.2	32.2
R and R-of-W	-	-	1.0	5.1	1.0	2.9
Total	15.1	100	19.7	100	34.8	100

It is evident from the two tables that about 40 percent of the cutover area does not have a good seedbed. It remains to be seen whether the classification is correct. Areas cut for sawtimber in past years were often left in much worse condition and yet fully stocked young stands now cover most of these tracts.

Possible treatments to insure a larger percent of good seedbed might include poisoning of dense brush and live cull trees that would interfere with reproduction.

The use of a poison spray (Ammonium sulfamate) to kill a dense cover of salmonberry, currant and blueberry brush proved efficient, but expensive. Using 54 pounds of poison per acre and a hand spray outfit, an acre of such brush was treated in 34 man-hours. The details of this are described under Stand Improvement on a later page.

Killing of live culls casting heavy shade on cutover areas, and of alder trees which often crowd the best seedbeds, is easily accomplished by the use of ammonium sulfamate crystals. Results of past tests (12) (1) showed that even in brushy undercover where travel is difficult a tree can be treated in approximately 5 man-minutes. Spring poisoning, using an axe-notch at 8-inch intervals around the circumference, and a tablespoonful of crystals per notch, resulted in death before autumn for spruce, hemlock and cedar. Alder kills more quickly, with less poison, and apparently dries up the formation of seed in a few weeks. (See Stand Improvement.)

The poisoning system developed is now being used as a Timber Stand Improvement measure on several Tongass Timber Sales. Poisoning may not always be needed as a quick death may result where logging leaves individual trees suddenly and fully exposed, particularly if the tree has been wounded by logging.

Experiments in basic silvics are going forward to determine the amount, species and quality of seedling growth and the causes of mortality on the various types of seedbed left after logging.

Virgin Bay, Traitors Cove. One of the largest clearcuttings of pre-pulp mill days. An area cut for sawtimber and piling in 1925, as it appeared in 1930. The tract was fully clothed in vegetation within 2 years and after 4 years tree reproduction is appearing here and there above the herbaceous vegetation. The same area in 1953, but looking at right angles to the above, is shown below.

d. How can the volume of these regenerated stands be roughly predicted on areas to be cut?

With much of the pulptimber logging to be on fairly steep slopes and high-lead logged, the outlook is favorable for good seedbed conditions and young stands having good stocking and a fast rate of growth. Future stands should be at least as good as those predicted in the yield tables published in 1934.[1/]

To predict future yields from these tables, stands at least 30 years of age are needed. In order to make at least a rough prediction of such yields before stands on cutover areas are 30 years old, some method must be worked out to relate yield table site index with site quality of the old-growth stands now being cut. Later this can be corrected and adjusted on the basis of actual performance.

As there was no known method of classifying the all-aged virgin stands into sites, a method was developed (23). This is based on number of 16-foot logs in trees in and above average diameter. Six logs is the best of climax old-growth. Stands having 7 or more logs are usually the even-aged bodies of sawtimber on which site index can be used. The 2-log stands are semi-scrub unmerchantable timber. This classification roughly indicates volume per unit-area, percent cull and percent species. It is being used by the forest survey and for rough, quick estimates of volume. Research areas now being logged are to be classified by this "log-height" system. As new stands develop on these cutover areas, their growth will be related to the classification of the former stand.

Already, certain indications of old-growth site, other than number of logs, are becoming evident. These are related to depth of undecomposed organic matter, depth of mineral soil and drainage. (7)

Table 3. Depth of organic matter and mineral soil related to site. Old-growth all-aged forest.

	5 & 6 logs	3 & 4 logs	2 logs
Depth of organic layer	7 inches	$10\frac{1}{2}$ inches	$19\frac{1}{2}$ inches
Depth of mineral soil	13 inches	$7\frac{1}{4}$ inches	$3\frac{1}{2}$ inches

e. How will logging of large areas for pulptimber affect salmon spawning streams?

Five years of calibration of 4 test streams is being completed in this study of the effect of logging on the physical characteristics of salmon streams. Logging has just begun on the

1/ Yield of second-growth western hemlock-Sitka spruce stands in southeastern Alaska, U.S.D.A. Tech. Bull. 412. March 1934.

watershed of one of these streams and will soon start on a second. Comparison of the before-logging pattern with the post-logging pattern will indicate changes of any significance due to logging. Two check streams will not be logged.

The normal pattern of stream levels, rate of discharge, rainfall on the watershed, debris in streams, stream bed and bank conditions and sedimentation will be reported on for the 5-year period during the coming year.

With the coming of pulp mills to Southeast Alaska, some people have visualized whole watersheds being laid bare, fire blackening miles of cutover land, and the heavy rainfall washing all the soil into the salmon streams. It might be pointed out that it is already known:

1. That only a minor part of the average watershed contains merchantable timber, hence pulptimber cutting could affect the runoff into the stream only on the small part that is cutover.

2. That forest fires have been extremely scarce in Southeast Alaska. On cutover areas, even after two weeks without rain, the duff below the litter layer remains wet.

3. That watersheds in this region of heavy rainfall remain almost continuously saturated. They are characterized by shallow soil mantles which generally overlay impervious bedrock, and so have little extra storage capacity during the seasons of heavy rainfall. Fall floods are normal. The rainfall on the watersheds without storage lakes, normally drains out within a few hours after it falls. Amount and rate of runoff could not be much greater as a result of logging.

4. Normal debris in the streams is constantly changing. In the case of Maybeso Creek debris seems to be building up over the past 5 years, none resulting from logging as no logging had been done at the time. In 1949 there were 517 pieces of debris consisting of logs, branches and trees 10 feet long or longer, protruding into the main channel. In 1953 there were 944 such pieces.

   In 1949 there were 9 natural log jams of 10 or more logs in Maybeso Creek. In 1954 there were 16, none of which prevented salmon from moving upstream.

5. Only 24 days of 551 days recorded showed water temperatures reaching 60° or more. The maximum reached was 66° F. in small Indian Creek and this lasted but a few hours. Temperatures during the period from the start of spawning in late summer to the end of fry migration out of the stream in the spring are never as high as 60° F.

Considering the above points, the danger seems to be in the possibility of erosion and silting from cutover areas where mineral soil is exposed - this erosion coming not from significantly greater amounts of rainfall running off, but from about the same runoff coming down the hill over these exposed areas.

Relationship between discharge and hourly precipitation

Figure 1 reveals the close correlation between stream discharge and precipitation. Only 0.2 inches of rain had fallen during the preceding 6 days and stream discharge probably represented approximate base flow. Only 0.15 inches of precipitation fell between the hours of 1 a.m. and 10 a.m., yet this small amount resulted in a discharge peak which occurred at 11 a.m. No rainfall was recorded between 10 a.m. and 11 a.m., and this is reflected in a lessening of stream discharge beginning at 11 a.m. Approximately one-half inch fell between 11 a.m. and 4 p.m. This precipitation resulted in a rapidly increasing discharge rate which rose from 15 cubic feet per second per square mile of watershed to 44 cubic feet per second per square mile. The time lag between peak precipitation intensity (0.2 inches between 3 p.m. and 4 p.m.) and peak stream discharge (occurring at 5 p.m.) was less than 2 hours.

This preliminary analysis indicates that the watershed of Maybeso Creek, representative of many streams in Southeast Alaska, is highly sensitive to precipitation intensity. Small amounts of rainfall, even as low as a few tenths inches, may cause minor peaks in stream discharge. Also revealed was the fact that the time interval between peaks of precipitation and peak runoff may be as short as two hours.

The storm of September 21 produced 0.86 inches of rainfall in a 24-hour period, or approximately 2 million cubic feet of rain per square mile of watershed. Total discharge for the 24-hour period was 1,500,000 cubic feet per square mile. This amounted to a runoff of approximately 75 percent of the total storm precipitation. Zach (19) in an analysis of two storms occurring in Maybeso Creek and nearby Harris River drainages, found that associated runoff accounted for 93 to 112 percent of the precipitation measured at sea-level.

Precipitation at higher altitudes is usually greater than that at sea-level. It is not uncommon for precipitation at sea-level stations to be less than stream discharge.

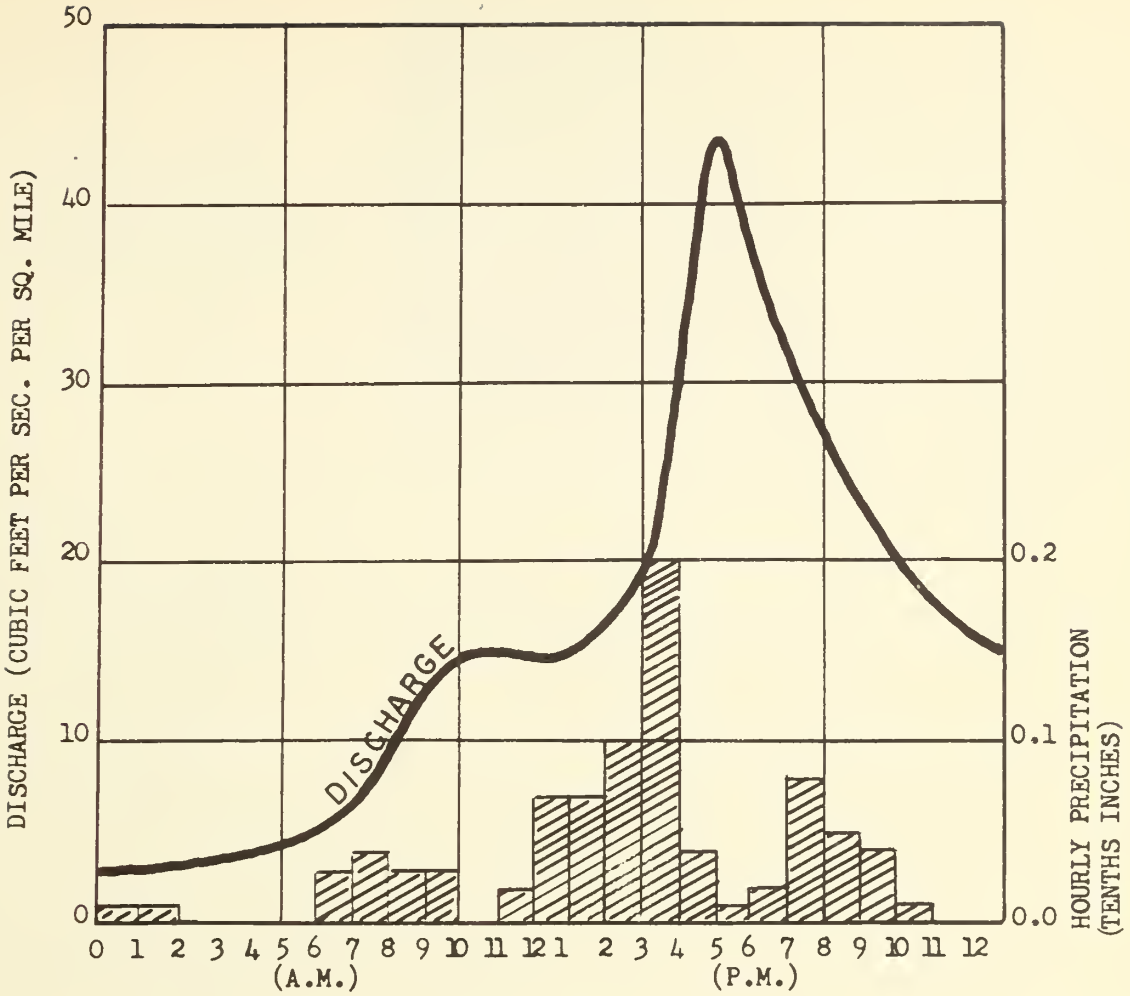

Figure 1. Streamflow hydrograph of Maybeso Creek showing relationship between discharge and hourly precipitation for September 21, 1954.

To determine the relative importance of the salmon stream problem in future logging, a survey of all such streams on the 50-year sale area of the Ketchikan Pulp Company was made. Preliminary indications are that:

1. There are 77 salmon streams on this 50-year cutting area. Thirty of these are very poor producers.

2. Merchantable timber on the watersheds of these streams constitutes somewhat less than half of total merchantable timber on the 50-year sale area. However, only the timber bordering or close to the stream itself is of importance in relation to possible damage. This represents a very minor amount.

3. Logging could present problems on a few of the streams of the Ketchikan Pulp Company sale area, and these streams will receive special consideration and study

Overhead cable car for taking flow measurements. Harris River gaging station.

before logging. On a great many, however, it appears that logging will not present any special problems because the timber stands are not located near the salmon streams.

This survey, made from air photos, visits to the streams or flights over them, and from timber type maps, will eventually pin-point the parts of individual streams needing special attention when logging on the watershed begins.

Findings of the study of physical changes as a result of logging should be available within 5 years. Recommendations for improvement in methods of logging on danger areas should be forthcoming before logging has been done on more than 7 or 8 of the 77 salmon streams. Meanwhile, of course, Forest Service timber sale contracts already provide for protection of salmon streams. No hauling is allowed down or across such streams except by bridge and no logging debris is allowed in the streams. Special precautions are considered with the U. S. Fish and Wildlife Service for each stream in question.

Natural log jams, not caused by logging, as there has been no logging in this watershed, are of common occurrence in many streams. This is no obstruction as river is large enough to fluctuate and cut new channel wherever jams tend to form a barrier. Harris River at a low stage.

Stand Improvement

It was mentioned under Harvesting Methods (c) that poisoning tests had been made and that the methods developed are being used by timber sale administrators in their Timber Stand Improvement work. Results of these tests (1) were confirmed in the preparation for a study of the possible conversion of semi-scrub to merchantable stands. In this study all trees on a large set of plots were poisoned, using ammonium sulfamate crystals.

Alder control

Alder may seriously retard establishment of desirable tree species under certain conditions in Southeast Alaska. It is particularly troublesome on deep well-drained soils along skid trails and at landings where mineral soil has been exposed. Since such areas may comprise 10-20 percent of a cutover area, a reduction or retarding of stocking can reduce ultimate yields of valuable timber considerably on some of the highest producing sites. While areas of alder are not extensive, the problem is of some concern to the forest manager.

In 1954 the Alaska Forest Research Center in cooperation with the timber management staff of the Southern Division, Tongass National Forest, conducted a test designed to control alder. The main objective was to attempt to prevent establishment of alder on a deep alluvial flat logged in 1954, by poisoning all alder seed trees on or adjacent to the area.

The stream bottom portion of the cutover area was approximately 35 acres in area. Large alder trees were scattered over the entire area but were mainly found along stream banks. Alder trees over 4 to 6 inches in diameter were poisoned by chopping small notches near the root collar at 8-inch intervals and placing a teaspoonful of ammonium sulfamate crystals in each cup. Smaller trees were chopped down and a small amount of the crystals placed on the cut stump. Approximately 652 stems on the 35-acre area were treated. The total costs were as follows:

4 man days @ $16.00	$64.00
55 pounds ammonium sulfamate @ $23.44/cwt.	12.89
	$76.89

Reduced to a unit basis, the cost of treatment was approximately $2.14 per acre or 12 cents per stem treated.

The area was treated June 22, and at that time the green alder cones were well-developed and full sized. Within a month the leaves of the poisoned trees turned black. At the end of two months the cambium was dead on practically all trees. No viable seeds were produced by treated trees. The treatment was apparently effective in preventing

large numbers of alder seed from being released on the cutover area and should reduce the amount of alder becoming established. While alder seed may fly considerable distances, transects on cutover areas reveal that the heaviest concentrations of alder seedlings are near an alder seed source.

Further studies and tests will be conducted before definite conclusions and recommendations can be made. Poisoning alder seed trees on or adjacent to cutover areas, however, may afford an economical control of alder and prove a worthwhile investment on good sites in Southeast Alaska.

Chemical brush control

In Southeast Alaska brush, principally salmonberry, black currant, and devils club, may invade cutover areas, particularly those on deep alluvial soils, to such an extent as to retard or reduce restocking by desirable tree species. While such brush areas as yet are not extensive the problem may become more acute with increased logging for pulptimber.

Experiments conducted by the Alaska Forest Research Center on brush control along trails (20) indicated that spraying with a solution of one-half pound of ammonium sulfamate per gallon of water gave effective control of most common brush species (20).

In 1954 tests were made of chemical control of brush on a 12-year-old cutover tract located along a small stream on the Maybeso Experimental Area. On the deep alluvial soil salmonberry brush was 6 to 8 feet tall and so dense it was difficult for a man to force his way through. Western hemlock and Sitka spruce seedlings were confined almost entirely to hummocks around stumps, the roots of windfalls or on rotten logs and stumps. Even in such locations regeneration was badly suppressed. Under the denser brush seedlings were non-existent. As a result stocking was patchy and severely retarded. Blueberry brush apparently does not seriously retard or suppress seedlings as a well-stocked stand of thrifty spruce and hemlock seedlings was established on a small blueberry covered ridge extending into the cutting.

Two blocks each with 6 (1/2 x 1 chain) rectangular plots were laid out in an area where brush was heaviest. Buffer strips were left between individual plots as well as between the blocks. Three plots in each block were selected by random numbers for treatment. All spruce and hemlock seedlings over six inches high were staked and numbered on a subplot within each plot. Total height and leader growth for the past two years were measured. Seedlings under six inches were marked by means of a wire pin.

Spraying was done with back-pack pressure type sprayers on June 24 after the current year's leaves had developed. Foliage was thoroughly wetted by the spray which was applied at a rate of about one gallon of spray per 400 square feet. This is equivalent to approximately 108 gallons of spray or 54 pounds of ammonium sulfamate per acre.

Within one month nearly all the foliage had withered and dropped. Bigleaf fern and salmonberry seemed most susceptible to the spray, followed by black currant and devils club. Hemlock seedlings proved very susceptible and mortality of hemlock was high. Sitka spruce seemed less susceptible and was not killed unless given heavy direct spray. New growth was affected by light spraying in some cases. Current leader growth had not been completed at time of treatment. Terminal and lateral leaders were succulent and seedlings probably especially susceptible.

Spraying, including the mixing of the solution and transporting water, poison and equipment, took 34 man-hours per acre. Approximately 54 pounds of ammonium sulfamate per acre were used.

The costs on a per-acre basis were as follows:

54 pounds poison crystals @ $23.44/cwt. f.o.b. Ketchikan	$12.66
34 hours @ $2.00 per hour	68.00
	$80.66

These costs are much too high to permit large-scale application of chemical brush control to such areas. Treatment should be given during the first five years, before brush reaches the size of that treated in this experiment. Spraying of spots or patches should allow seedlings to become established. Once well established both hemlock and spruce seedlings, which are relatively tolerant when young, can apparently overtop the brush. Follow-up tests of patch spraying will be made.

Conversion of semi-scrub stands

An experiment was begun in 1954 on the Maybeso drainage to test the possibility of converting semi-scrub to merchantable timber. Such stands are characterized by a predominance of western redcedar, almost no spruce, low form class and dense brush, usually *Vaccinium* spp. Most of the characteristics displayed by these stands are due to the inherent low productivity of the site. Despite this, it appears conceivable that if the overmature stands are once removed and the seedbed prepared these sites might be capable of producing merchantable second-growth stands.

The stand selected is an example of one with a fairly high gross volume but having too much rot and too much cedar. It averaged 4 logs by the climax classification system. This is better than semi-scrub. It had 8,175 cubic feet gross, per acre, was 77 percent cedar and 57 percent cull by gross volume.

A total of 9.6 acres comprising 1108 live stems was poisoned as a first step in treatment of the randomized block of plots. Future treatments will include scarification, burning of surface litter, seeding and combinations of these.

One hundred year-old hemlock-spruce second-growth contained 14,000 cubic feet per acre. Thinned 37 cords, leaving 104 cords per acre. Reserved stand contains 120 crop trees per acre averaging 18.5 inches in diameter, or 9,940 cubic feet per acre.

Improvement of second-growth stands

Improvement of young, good site, 40-year-old second-growth and approximate rotation-age 100-year-old second-growth by means of thinnings has been studied on a small scale. Results will be indicated within a few years as growth following treatments is recorded.

Basic Silvics Research

A thorough understanding of the effect of the various site factors (moisture, temperature, light, chemical and physical) on seed production, seed dissemination, germination, survival and early growth of seedlings and eventually, on all phases of tree growth, is necessary in order to understand the whole problem of regenerating cutover areas and obtaining the desired species and growth. Over the past 5 years several studies in the above category were made, some on site factors, some on the results of site factors, such as seed production. Gradually a fund of information is being built up.

General climatic factors

A general summary of average temperature, precipitation and length of growing season was made as a basis for general considerations of tree growth.[1] Isotherms of mean temperatures for the period May through September show that they generally decrease northward. As may be expected in a mountainous region, there are great variations in climate within short distances.

1/ Andersen, H. E. Unpublished report.

Moisture studies

Lack of soil moisture has not been found to be a critical factor in the germination and establishment of seedlings except in the surface moss which is sometimes left undisturbed by logging. Only a fifth as many seeds germinate in the moss as on mineral soil and these had 28 percent lower survival. Poor germination in the moss is largely attributed to lack of moisture, although during the growing season more than 3 inches of rain fell every month. Soil moisture is always sufficient for growth on cutover areas in Southeast Alaska at 1 inch below the surface, but surface moss dries out in midsummer to as low as 31 percent moisture content within a few days after a rain. In late July maximum temperatures in the moss ranged from 100° to 117° F.

Although minimum moisture content is always present below the 1 inch depth, soil moisture, as reflected by drainage, has a great deal to do with site. Good drainage is associated with the deeper mineral soils, shallow accumulations of undecomposed organic matter, and good growth. Impeded drainage is associated with deep organic layers and scrubby growth. With annual rainfall averaging over 100 inches in Southeast Alaska drainage plays a large part in rate of growth.

Temperature relations

Soil and air temperatures were recorded in open clearcut and undisturbed timbered areas during 1952, 1953, and part of the 1954 field season. Continuous records were obtained at an open and a woods station of air temperature at 3 feet and soil temperature at a 3-inch depth. The location of both the open and woods stations were changed each year. Additional temperature observations were taken at various air and soil levels with ordinary mercurial thermometers at the continuous recording stations and other nearby locations.

Temperatures were noted to differ appreciably with:

1. Distance above and below ground surface.
2. Forest cover.
3. Character of ground surface.
4. Soil type.
5. Topographic position.

Distance above and below ground surface

Afternoon observations in the open showed that the highest daytime temperatures occurred at the soil surface. Surface temperatures of 100° F. to 106° F. were common on clear summer days. The highest temperature observed was 123° on a moss covered surface, and 118° on a mineral soil surface, both of which occurred on a southwest exposure. Surface temperature extremes were negligible in the woods; the highest temperatures generally occurred at 3 feet above the ground, and gradually dropped as the soil surface was approached and soil depth increased.

Table 4 shows summer daily and summer mean monthly temperature extremes indicated by continuous recorders.

Table 4. Temperature extremes and ranges.

		Temperature° F.			
		Air-3 ft.	Range	Soil-3 in.	Range
Summer daily extremes					
	Open	35-90	55	44-80	36
	Woods	38-78	40	40-62	22
Summer mean monthly extremes					
	Open	42-74	32	49-67	18
	Woods	47-68	21	44-56	12

The greatest range in daily temperatures occurred during periods of warm, clear weather which permitted maximum gain and loss of heat by radiation.

In the open, monthly means showed that air maxima were from 2.3° to 6.6° higher than soil maxima, and air minima from 1.0° to 6.6° lower than soil minima. There was usually less than 1.0° difference between mean air and mean soil temperature.

In the woods, monthly means showed that air maxima were from 3.8° to 12.2° higher than soil maxima, and air and soil minima were about the same.

Mean air temperatures were from 0.9° to 6.4° higher than mean soil temperature. For both the open and woods, the warming period ended during September.

Forest cover

Maximum temperatures were consistently higher in the open. The mean monthly difference in summer air maxima ranged from 1.9° to 8.6° F.; and for soil maxima, from 3.4° to 13.4° F. The largest daily difference recorded for air maxima was 18° and for soil maxima, 24°; both of which occurred on the same day when air in the open reached 90°.

At the lower air minima encountered, the difference between the open and woods was negligible. The difference increased as air minima increased. In 1952 the difference was in favor of warmer temperatures in the open, presumably due to the modifying effects of the salt water body near the open plot. The reverse existed in 1953 and 1954.

Open soils warmed and cooled earlier and more rapidly than woods soils, and displayed an average monthly increase in daily range of from 1½° to 8½° F.

The greatest temperature difference between the open and woods as a result of clearcutting (as displayed by the continuous records) was in soil temperature. Next in order of magnitude was air maxima. Air and soil minima were affected least.

Character of ground surface

The highest surface temperatures were observed on undisturbed, moss-covered organic layers, due to the dark color and poor conduction of heat downward. A dark brown mineral soil surface displayed the next highest, and a light brown mineral soil surface the lowest temperatures.

Soil type

The temperature drop below the surface of loosely packed organic bog soils is very abrupt in comparison with firm mineral soils. The average of readings made on seven different clear summer days at about the time of air maximum showed a difference of about 12° between the dark colored mineral and bog soils at the 1-inch soil depth; about 12° at the 3-inch level; and about 8° at the 6-inch level. The loosely packed bog soils are poor conductors during dry summer periods.

<u>Tolerance of cedar</u>

In the course of basic silvics studies associated with germination and growth, it was found that western redcedar is not as tolerant of shade as has been supposed. Sudworth rated it as very tolerant, with greatest tolerance shown toward the south end of its range. Others have rated it as very tolerant. Possibly it becomes rather intolerant at the northern end of its range (2) and on poor sites. The curve for cedar in Figure 2 is similar to that of an even-aged stand while both species of hemlock display the all-aged type of curve.

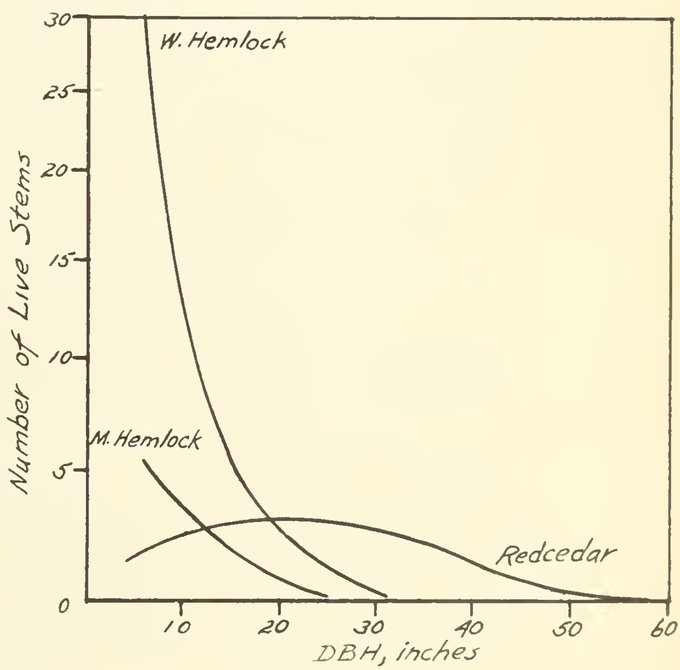

Figure 2. Frequency distribution of live stems by 2-inch d.b.h. classes. Per Acre basis.

Cedar is present in the seedling stage, but apparently does not survive and grow under dense canopies of other species. This would indicate that unless cedar gains a dominant place in the new stands on cutover areas, it will not survive.

Seasonal distribution of leader and radial growth

First year data from the Ketchikan area of the Tongass National Forest showed that leader growth of Sitka spruce and western hemlock saplings began about May 15. Leader growth of spruce terminated about August 1 and hemlock about September 15. Slightly over half of the total spruce leader growth was made during the three weeks of June 13 to July 3 with the greatest weekly growth (19 percent of the total) occurring between June 19 and 26. Ninety percent of the spruce leader growth was completed in the seven weeks from May 30 to July 17.

Hemlock's greatest weekly leader growth (14 percent of the total) was made between July 10 and 17, three weeks later than that of spruce. Fifty-eight percent of the hemlock leader growth occurred between June 27 and July 30. Ninety percent was completed in the ten weeks from June 13 to August 20.

Individual trees varied in their weekly growth rates without apparent reason, but the seasonal totals were similar. After the peak period, weekly growth decreased at about the same rate as it had increased though hemlock tended to fall off at a slightly faster rate. The first measurements were taken on May 23 when the terminal buds were partially open.

Radial growth of the tree bole at breast height as measured by a dendrometer showed less precise seasonal peaks than did leader growth in the Ketchikan area of the Tongass National Forest. In general, growth began about May 15 with the greatest portion of the seasonal growth occurring during the seventh week (June 26-July 2). Second-growth trees averaged 15 percent and old-growth 18 percent of the seasonal total during this period.

The relative rates of growth by species changed during the season. In second-growth hemlock 50 percent of the increment was complete by the sixth week. Redcedar required 7 and spruce 7½ weeks. Old-growth spruce and hemlock required about 7½ weeks. Ninety percent of the second-growth increment was complete in 11½ weeks for spruce and about 13½ weeks for hemlock and redcedar. Old-growth spruce and hemlock required about 13½ weeks.

Second-growth spruce and hemlock had essentially completed growth by the 14th week, August 20. Redcedar showed no definite cessation as late as September 24 when the last observations were taken. Old-growth spruce and hemlock appeared to terminate at 17 weeks in mid-September. After mid-August, as a result of cloudy, rainy weather affecting the rate of transpiration, radial change by individual trees and species showed considerable variation.

Seed dispersal

A bumper cone crop in 1951 over all of Alaska has been followed by extremely light seed crops in Southeast Alaska. The 1951 crop produced

91 pounds of seed per acre in a rather typical climax forest in the Juneau area. This pulptimber stand consisted of 86 percent western hemlock and 14 percent Sitka spruce by cubic volume.

The hemlock seed crop of nearly 86 pounds per acre was disseminated over a period of 15 months. The spruce seed crop, totalling slightly over 5 pounds per acre, was disseminated over a period of 14 months. The amount and periodicity of seed release was closely associated with the amount of atmospheric moisture. A large percentage of the seeds falling at the end of the period germinated in the traps because of favorable temperatures and moisture conditions. In the latter part of the dissemination period, alternate wetting and drying of the cones appeared to loosen the seed and help open the basal scales of the cone. The 1952 seed crop was a failure in this area. Color of seed and immediate germination of much of it indicated the 1951 origin of this late-falling seed.

Sixteen seed traps, each 2' x 3', were equally spaced over an acre within the stand for determining the amount and period of seed dissemination. Weekly observations were made until January 4, 1952; then at irregular intervals until February 5, 1953. Seed dispersal began during the week of September 21-28, about two weeks after the seed ripened.

Nearly 78 percent of the spruce and 59 percent of the hemlock seed was released in October. The greatest weekly dispersal occurred during a dry, windy week in October. Seventy-two percent of the spruce and 54 percent of the hemlock, 3.7 pounds and 46.1 pounds respectively, fell during this week. Spruce was released in relatively even proportions from November through April. A heavy fall of hemlock seed occurred in December and during March and April, amounting to 22 percent and 11 percent respectively. The last seed from the 1951 crop fell in early November 1952.

Working Tool Studies

Volume tables

A check of form class volume tables against tree measurements of western redcedar showed that the form class tables are accurate for board foot volumes as far as they go. Extensions for the tables for 32-foot logs to include values for form classes 56, 58, 60 and 62 were made by means of the equations given by Girard and Bruce 1/. These volumes were converted to Scribner Decimal C.

The existing cubic foot form class tables made by the Alaska Forest Research Center (16) for spruce and hemlock do not fit the cedar tree measurements.

1/ Girard, J. W. and D. Bruce. Board Foot Volume Tables for 32-foot logs. Mason, Bruce and Girard, Portland, Oregon.

The cubic form class tables were adjusted for cedar by applying a regression formula which was a near-linear relationship. New tables for western redcedar were read off. The aggregate difference of the test trees from the new tables is + 0.6% and the mean deviation is 7.7 percent. A 6-inch top, or utilized top, can be taken from the tables.

Average form class was determined for the three species, Sitka spruce, western hemlock and western redcedar:

	32' logs	16' logs
Sitka spruce	76.4	82.4
Western hemlock	75.8	82.2
Western redcedar	65.0	75.0

The usual difference between the form class for spruce and hemlock of 32-foot logs and 16-foot logs ranges from 8 points in form class 60 by 32's to 5 points in form class 86 by 32's. Cedar data were insufficient to determine this factor.

FOREST PROTECTION

Forest Insects

The black-headed budworm survey

During the summer of 1954, the black-headed budworm[1/] outbreak covered approximately 6,740,000 gross land acres of the Tongass National Forest and Glacier Bay National Monument in Southeast Alaska. The outbreak was situated within the northern portion of the forest, north of Frederick Sound. South of Frederick Sound and in the Yakutat area budworm activity had died out. (Figure 3.)

Western hemlock suffered heaviest defoliation in the Lynn Canal and Icy Strait areas (north and west of Juneau). Scattered pockets of moderate to heavy defoliation, with some light top killing, were found on Chichagof Island, along the west coast of Baranof Island, and in a few localities on Admiralty Island. In general, budworm feeding in 1954 was much lighter than that which occurred in 1953.

Hemlock forests south of Frederick Sound are recovering after years of defoliation by the budworm. The forests for the most part have taken on a green appearance after an extended period when much of the country reflected a reddish cast. Some large patches of severe hemlock top kill, gray in color, are found at Moira Sound, Cholmondeley Sound, Polk Inlet, Ratz Harbor to Red Bay, all on Prince of Wales Island, and on Wrangell Island and Mitkof Island. Top kill on Admiralty, Baranof and Chichagof Islands cannot be mapped with certainty at this time.

1/ *Acleris variana* Fernald.

Complete tree kill is negligible. At Juneau in Evergreen Bowl and along the Mt. Roberts trail, some scattered tree kill in young pole-size hemlock may have taken place as a result of budworm feeding. This tree kill is not detrimental to the stand since suppressed hemlock were killed, and a light thinning of the stand produced.

The hemlock sawfly[1/] outbreak south of Frederick Sound has died out. The sawfly continues to accompany the budworm northward, but is light in most areas. Excursion Inlet, near Icy Strait, contained considerable evidence of sawfly this year and undoubtedly there are other such areas. Defoliation at Excursion Inlet was not considered serious.

Hemlock twig samples collected at widely distributed locations on the Tongass National Forest were examined for budworm eggs in order to determine the extent and severity of defoliation which could be expected in 1955. These examinations indicate the following:

1. The black-headed budworm outbreak in Southeast Alaska is rapidly drawing to a close. No widespread defoliation of serious magnitude, i.e., heavy enough to cause top kill, is expected in 1955.

2. Some light but noticeable budworm feeding may take place north of Juneau at a few locations scattered throughout the Lynn Canal and in the vicinity of Icy Strait-Glacier Bay.

3. Hemlock forests which suffered heavy defoliation in past years should begin to recover and gradually regain their growth.

<u>Studies of biology and control</u>

Studies of the biology and control of the black-headed budworm in Alaska were initiated in 1953. Major emphases of the work carried on that year were directed toward determining the life history of the budworm, its feeding habits, susceptibility to artificial control and importance and kinds of natural control agents. Studies were continued during 1954 with emphasis placed on budworm damage, certain artificial control refinements and more intensive investigation of the natural control agents.

Results of the 1954 investigations are summarized below:

1. Average maximum temperatures three to four degrees lower than in May, June and July of 1954 are believed to have contributed to retarding budworm development by one month.

2. Budworm fecundity remained constant as the outbreak continued to die down.

1/ *Neodiprion tsugae*, Middelton.

3. One year of heavy budworm defoliation on hemlock advanced reproduction caused top kill in 81 percent of the dominant hemlock trees, 71 percent of codominants and 23 percent of the intermediates. The average length of top kill for the dominant and codominant trees was 2 feet and $1\frac{1}{2}$ feet respectively.

4. One year of heavy budworm defoliation on Sitka spruce advanced reproduction and pole timber caused leader kill in 86 percent of the dominant spruce trees, 71 percent of the codominants, 71 percent of the intermediates, and 29 percent of the suppressed spruce. All current year's growth was defoliated throughout the top 16 feet of the dominant spruce, the top 8 feet of codominant spruce, and the top 4 feet of the intermediate spruce.

5. Heavy, but not extreme, black-headed budworm damage to mature western hemlock stands caused top kill in 21 percent of the codominant crowns and 14 percent of the intermediates. This top kill averaged 12 feet and 5 feet respectively.

6. The tops of hemlock were broken or forked previous to the present budworm infestation on 44 percent of the dominant trees, 23 percent of the codominants and 14 percent of the intermediates. Some of this old damage is believed to be evidence of previous budworm attack.

7. Small scale insecticide tests against black-headed budworm eggs show that 4 percent nicotine sulphate and 2 percent "Kleenup Soluable" will give satisfactory kill. Practical field tests should now be conducted using these two insecticides.

8. Hymenopterous and Dipterous parasites continue to be reliable control agents of the budworm epidemic. Disease did not appear as a significant controlling force in the Juneau area in 1954, although in 1953 it was very effective in some areas.

<u>Other forest insect activity</u>

Forest insect activity throughout the Territory of Alaska is at a low level. With the exception of the black-headed budworm epidemic on the Tongass National Forest, no serious infestations were found or reported during 1954.

The hemlock sawfly outbreak which extended over much of the southern half of the Tongass National Forest has died out. The sawfly continues to accompany the budworm northward, but is light in most areas.

The western rusty tussock moth was noticed to be very prevalent in the vicinity of Anan Creek and Neets Bay. Damage to hemlock was not heavy in these areas. As a rule the tussock moth is not a serious forest enemy.

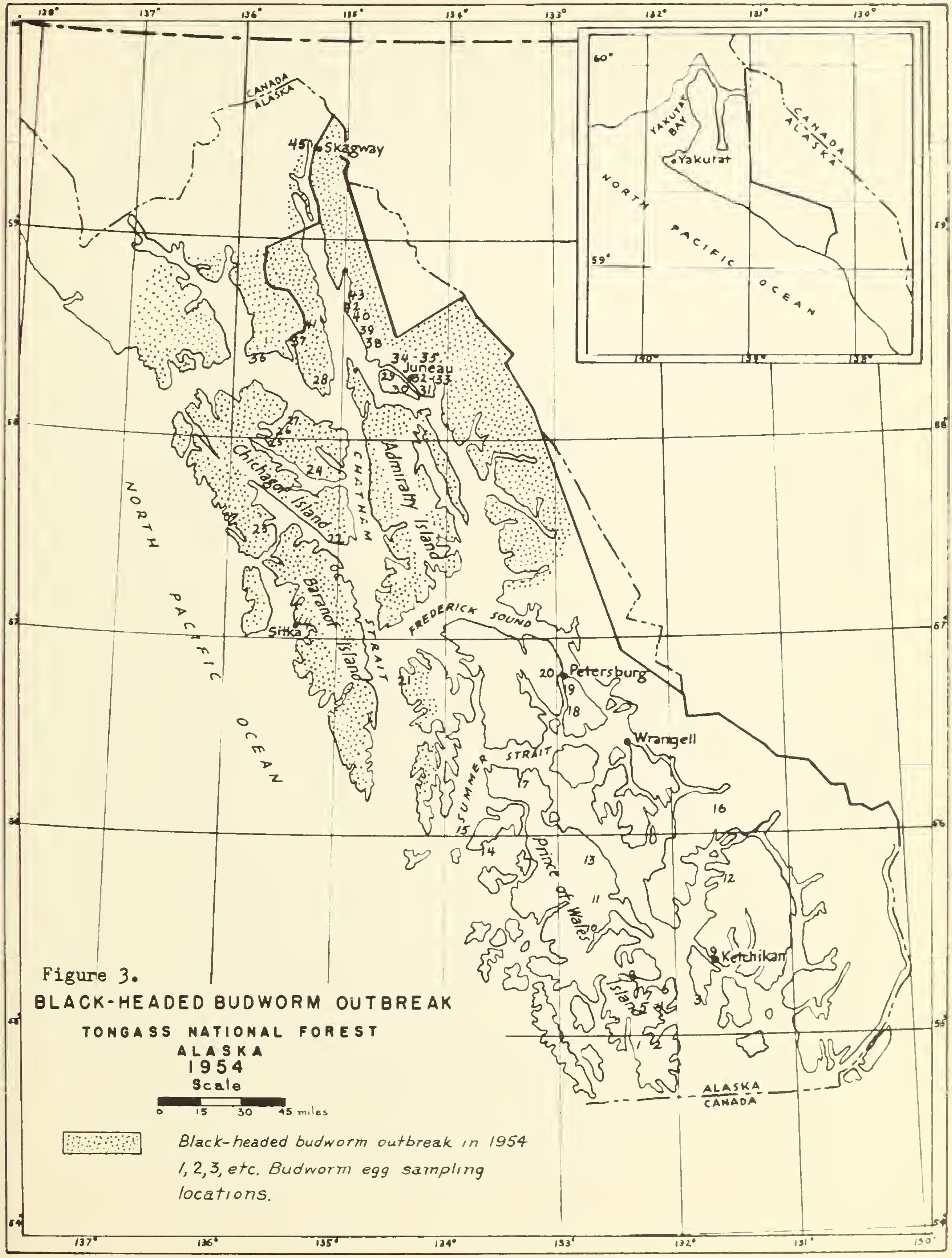

Figure 3.

BLACK-HEADED BUDWORM OUTBREAK

TONGASS NATIONAL FOREST

ALASKA

1954

Scale

0 15 30 45 miles

Black-headed budworm outbreak in 1954

1, 2, 3, etc. Budworm egg sampling locations.

Cedar bark beetles were much in evidence this year. Both western red and Alaska yellow cedars are being infested. Beetle attacks are most common in cedar growing on muskegs and on the poorest of cedar sites.

Park Service Lands

The black-headed budworm was very noticeable throughout approximately 400,000 acres of the Glacier Bay National Monument. Both western hemlock and Sitka spruce were being defoliated. This defoliation was not heavy, and unless repeated, little damage is expected.

Public Domain Lands

Vast areas of larch in the upper Kuskokwim River drainage died last year from unknown causes. Examination of some of these larch stands revealed the larch beetle distributed lightly in most of the trees. The larch trees under attack are small and of little economic importance at this time.

The alder-covered slopes in the vicinity of Valdez are undergoing a severe epidemic by a looper. Defoliation was almost complete over thousands of acres during this, the second year of attack. Dead larvae exhibiting symptoms of disease were in abundance and it is possible the outbreak will be greatly reduced next year. No permanent damage has occurred to the alder.

Forest Diseases

Forest disease surveys by a forest pathologist detailed from the California Forest and Range Experiment Station were continued in 1954. These serve to build up the collection of known diseases both in Coastal and Interior Alaska and to discover areas heavily infected by disease. In Southeast Alaska fairly detailed disease surveys of the Tongass National Forest have been completed from Dixon Entrance to Wrangell. The approximate over-all cull to be expected as a result of heart rot and other diseases in this southern area on which the first pulpmill is logging will be reported on in a few months.

The northern half of the Tongass has received only extensive coverage. It should and probably will be covered as intensively as the southern part. Pulptimber areas being investigated by companies interested in establishing pulp mills must be appraised as to the disease factor.

Periodic surveys will be needed in future but the most urgent need, now that diseases have been identified, is to determine the outer indications of rot, especially heart rot, in the old-growth climax forest. Timber inventories will not be accurate until the survey men and timber cruisers can properly appraise the defect in trees.

Forest Fires

Losses from forest fires have been negligible in the past in Southeast Alaska. Logging for sawtimber clearcut small areas, the largest being 300 acres or so prior to the pulpmill logging. These old logging jobs gradually developed from high-grading the best spruce out of a stand and leaving the rest, to present clearcutting methods where a great deal of slash is left on the ground.

Pulptimber logging, at least where high-lead is used, results in a much better cleanup and a great deal less slash. Larger areas may be cut-over than in the past and if logs are left on the cutting for long periods during the summer, a good deal of damage could be done to them by fire. The cutover area would not suffer too much. A light fire would improve the soil for seedlings, especially on the poor sites. A severe burn removing much of the litter and humus would be harmful, however.

Where large clear-cuttings are indicated, aside from the Maybeso Creek drainage where the clearcut area is large for experimental purposes, combination seed-block firebreaks of green timber will be left uncut at intervals. If it is later determined that these are unnecessary from the seed dissemination and fire angles, they could be discontinued.

With occasional "droughts" of as much as two weeks with no rain, it is worthwhile to know something about fire danger in Southeast Alaska.

In the Olympics, Morris[1/] reports that fires in slash areas spread rapidly when fuel sticks in the slash areas have a moisture content of less than 15 percent. If fuel sticks exposed to the sun in the slash area have higher than 15 percent moisture content, fine slash usually will not carry fire. A fuel stick in the shade of bordering green timber should have a moisture content of 18 percent or more to avoid difficulty in preventing and controlling spread into the timber by surface and spot fires.

Table 5 shows relative humidity, precipitation for the period since last reading, moisture content and wind velocity at the time of observation and consequent burning index, by Region 6 standards.

There may have been intervening days when the moisture content was 15 percent or less, as daily trips to the silvics plots where the fuel moisture sticks were placed were not made especially for fire weather readings unless it was a hot, dry day.

1/ Morris, W. G. Fuel moisture indicator stick as guide to slash burning. Timberman, Vol. LIV No. 10, Aug. 1953.

Table 5. Fire danger data, Hollis cutover area, 1954.

Date	Relative Humidity	Precipitation	Moisture Content Fuel Sticks	Wind Velocity	Region 6 Burning Index	Region 6 Burning Index Class
	%	inches	%	MPH		
July 14	52	0.01	10	4.5	2	2
22	96	1.42	50+	0.0	0	0
26	73	0.41	21	0.0	1b	1
31	92	0.04	26	0.0	0	0
Aug. 6	Max.	0.18	48	0.0	0	0
8	48	0.02	12	0.0	1b	1
9	79	0.00	15	8.5	1a	1
10	74	0.00	13	6.0	1a	1
11	74	0.00	14	7.5	1a	1
12	73	0.00	14	0.0	1b	1
13	71	0.00	13	6.0	1a	1
20	64	0.44	12	11.0	2	2
24*	41*	0.00	7	7.4	15	5
27	43	0.00	8	8.0	10	4
Sept. 1	74	0.02	18	6.0	1b	1
3	53	0.00	9	7.0	6	3
8	Max.	2.14	50+	9.0	0	0
14	Max.	0.25	50+	0.0	0	0
21	Max.	0.66	50+	7.5	0	0
29	Max.	3.62	24	0.0	1b	1
Oct. 4	Max.	0.00	9	7.0	6	3
19	Max.	6.07	Satur.	8.0	0	0
23	Max.	9.30	"	3.0	0	0
31	Max.	3.26	"	3.0	0	0

* Average of 5 readings during day.

PUBLICATIONS TO DATE
of the
Alaska Forest Research Center

Technical Notes

(1) Andersen, H. E. Girdling and poisoning of live culls. March 1953. No. 21.

(2) Andersen, H. E. Range of western redcedar (Thuja plicata) in Alaska. March 1953. No. 22.

(3) Godman, R. M. What kind of trees make the best growth in Southeast Alaska. Nov. 1949. No. 2.

(4) Godman, R. M. Thinning second-growth hemlock-spruce for pulpwood. Feb. 1951. No. 7.

(5) Godman, R. M. A site classification and "quick-cruise" volume table for climax stands. March 1951. No. 11.

(6) Godman, R. M. Seed dispersal in Southeast Alaska. March 1953. No. 16.

(7) Godman, R. M. and R. A. Gregory. Physical soil characteristics related to site quality in climax stands of Southeast Alaska. March 1953. No. 17.

(8) Godman, R. M. Moss retards regeneration in Southeast Alaska. March 1953. No. 18.

(9) Godman, R. M. Seasonal distribution of leader growth. March 1953. No. 19.

(10) Godman, R. M. Seasonal distribution of radial growth. March 1953. No. 20.

(11) Klein, J. A. Defect in the climax forests of Southeast Alaska. March 1951. No. 9.

(12) Klein, J. A. Girdling and poisoning of live culls. March 1951. No. 13.

(13) Lutz, H. J. Forest fires in Alaska damage more than timber. April 1950. No. 5.

(14) Taylor, R. F. First records of growth for Southeast Alaska's young stands. Nov. 1949. No. 1.

(15) Taylor, R. F. First results of thinning in Alaska. Nov. 1949. No. 3.

(16) Taylor, R. F. Cubic form class volume tables for Southeast Alaska. May 1950. No. 6.

(17) Taylor, R. F. Preliminary yield tables for Alaska's Interior forests. March 1953. No. 14.

(18) Taylor, R. F. Preliminary cubic form class volume tables for white spruce in Alaska. March 1953. No. 15.

(19) Zach, L. W. Effect of rainfall on stream flow in Southeast Alaska. April 1950. No. 4.

(20) Zach, L. W. Past logging affects little of watersheds. Chemical brush control. March 1951. No. 8.

(21) Zach, L. W. Distribution of volume in Southeast Alaska trees. March 1951. No. 10.

(22) Zach, L. W. Measuring log lengths. Random plot cruising. March 1951. No. 12.

Articles in Print

(23) Godman, R. M. A classification of the climax forests of Southeastern Alaska. Jour. For., 50:6. June 1952.

(24) Lutz, H. J. The concentration of certain chemical elements in the soils of Alaskan archaeological sites. Am. Jour. Science, Vol. 249, Dec. 1951.

(25) Lutz, H. J. Damage to trees by black bears in Alaska. Jour. For. 49:7, July 1951.

(26) Lutz, H. J. Occurrence of clefts in the wood of living white spruce in Alaska. Jour. For. 50:2, Feb. 1952.

(27) Taylor, R. F. and R. M. Godman. Increment and mortality in Southeast Alaska's second-growth stands. Jour. For. 48:8, Aug. 1950.

(28) Taylor, R. F. Alaska forest research problems and program. From selected papers of Second Alaskan Science Conference, 1951.

(29) Zach, L. W. A northern climax, forest or muskeg? Ecol. 31:2, April 1950.

(30) Zach, L. W. A practical stream gauge recorder house. Jour. For. 48:7, July 1950.

Processed Material

(31) Andersen, H. E. Mapping program in Southeast Alaska and its application to forestry. Mimeo. From Third Alaska Science Conference, Sept. 1952.

(32) Caporaso, A. P. The forest survey of Southeast Alaska. Mimeo.

(33) McCambridge, W. F. A summary statement of forest insect conditions in Alaska, Season of 1954. Mimeo. Nov. 15, 1954.

(34) McCambridge, W. F. The black-headed budworm survey on the Tongass National Forest, Alaska. Season of 1954. Mimeo. Nov. 15, 1954.

(35) Taylor, R. F. Forest research possibilities in Alaska's Interior. Mimeo. 1951.

Station Papers

(36) Lutz, H. J. The effects of forest fires on the vegetation of Interior Alaska. Oct. 1953. No. 1.

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